

XLVII. *Remarks occasioned by the publication of a Work entitled "Insect Life." By J. W. DOUGLAS, Esq.*

[Read March 2, 1846.]

THE phenomena of insect life are so various and wonderful, and we are so ill able to account for many of them, that whatever professes to throw a new light thereon is worthy of some attention. I have therefore thought it right to bring under the notice of the Society the ideas contained in a book lately published by Dr. Badham,* and presented to this Society by the author; and I am the more induced to do this, that I have neither seen any notice of it in the reviews, nor heard any mention of it here, and it might appear that Entomologists tacitly acquiesced in the startling notions it contains. I wish this notice had fallen into abler hands, but it will I trust have the effect of exciting observation and discussion, that thereby the truth,—the great end of the naturalist's researches,—may be ultimately elicited. To avoid misrepresentation I shall give the author's own words, adding a few remarks as I proceed.

The book opens with some observations on the difficulty that exists, where the forms of animal and vegetable life converge, of pointing out the characters by which they may be referred to their respective kingdoms, showing that neither in structure, want or power of motion, food, modes of increase, chemical constitution, nor sensibility, is the distinction to be found. It is said, "the possibility of fixing any limit between the two kingdoms presupposes that the highest order of plants is lower than the lowest specimen of animal life; whereas to the careful observer, the scheme of nature does not present a graduated scale, on which every class is necessarily higher or lower than the next, there being many living productions which, while on several grounds they bear a strong analogy to the animal world, are yet in other respects (such as complexity of organization or variety of function) lower than ferns or lichens, or even than some of the phenerogamic classes. When indeed we arrive at less questionable examples, wherein may be traced the substance of one order and the machinery of another, the voluntary motion of this tribe and the irritable tissues of that, co-existent in all their completeness, every

* "Insect Life," by David Badham, M.D., late Radcliffe Travelling Fellow of the University of Oxford; F.R.C.S. London; M. Ent. Soc. France. W. Blackwood and Sons, Edinburgh and London, 1845.

thing which is considered necessary to the constitution of an animal is so unequivocally present, that any one would be laughed at who should refuse to bestow that title on their possessor (an insect for instance), and yet by the familiar use of this word, animal, we are led to form conclusions unsupported by experience, and, starting with the belief that it implies a being that feels, we argue from the name to the fact, and from the fact back again to the name.”

Next is the assertion, “that insects do not feel.” “The power to feel appertains only to those creatures in whom the life of growth has reached its consummation. It is admitted on all hands that higher degrees of intelligence are associated with higher degrees of anatomical structure, especially of the nervous system, and it is equally certain that the sensibility of creatures is in proportion to their intelligence : hence we should expect sensation to be more or less perfect according as the nervous system is more or less developed, and its amount to be immediately connected with all those physical conditions upon which intelligence has also been ascertained to depend, viz. the temperature and colour of the blood, the absence or presence of a spine, and the form and substance of the brain. Accordingly, it ought to follow that the sensibility of creatures of cold blood, such as fish, amphibiæ and reptiles, where few or no traces of intelligence can be discovered, should be proportionably low ; and in point of fact the signs of it are very faint and few. Surely, therefore, when we descend lower still, and come to creatures of the same kind as Anacreon’s *Cicada*,—creatures altogether without blood(!)—and this deficiency is common to all the insect tribes,—it is reasonable to expect that the sensibility of which we had observed the progressive decline in passing from the higher to the lower qualities of the circulating fluid, should here be totally obliterated.”

A comparison of the nervous system of the different orders of animals is then made, showing that in the brain and spinal cord of the vertebrata “all that qualifies the animal to feel is centralized, and from the same originating cord all that enables it to move proceeds to its destination.” In the class of insects, on the contrary, there is no brain ; “a medullary cord runs through the whole body of the animal, giving branches to the different organs in its way. Placed at intervals upon this cord, something like beads, or lying between its two elementary threads, are seen roundish knobs, which have obtained the name of ganglia : they are various in size, uncertain in number, and are placed at unequal distances in different tribes of insects ; but in no case do they, as far as visible structure is concerned, present the least similarity to

the brain." It is moreover stated, that there is a direct connexion between the temperature of animals in general and the amount of red globules in their blood, and that there is as marked a connexion between the amount of sensibility and of animal heat as there is between the latter and the amount of cruorine in the blood; from all which it is inferred, that as sensibility is in proportion to the size and quality of brain, and the amount of red globules in the blood, a creature which has no brain and "no red blood" (just now it was "altogether without blood") should be devoid of sensibility.

There are also, it is stated, several points in which the physiology of insects resembles that of plants rather than that of animals, viz. perpetuation and superfcetation of species, longevity if the functions of generation be delayed, evolution of heat under certain circumstances, the generation of spontaneous light, and the operation of poisons.

This, then, is an outline of the theory that insects are devoid of sensation. The proofs adduced are the following:—

TOUCH.

In the higher animals, "the particular senses are so far independent of the diffused sensibility of the organs which administer to them, that the sense, or *particular* office of the nerve, may be lost, while the sensibility of the external structure remains. In amaurosis, or extinction of the visual power, the general sensibility of the retina is retained; the ear which has lost its hearing may ache; both taste and smell have been nearly abolished, without in the least impairing the common sensibility of the mucous membrane of the mouth and nose. But the reverse will by no means be found to follow: we have no experience of the ear, the eye, the palate or the nostril carrying on their peculiar functions after the general sensibility of the tissues has been extinguished. In touch we have positive experience to the contrary; a skin on which stimuli would fail to act,—a skin which could neither smart, ache, nor be tickled, ceases to be the organ of touch, as we see it exemplified in the effects of intense cold, which, by depriving the surface of that blood which supports and vivifies its subtle organization, numbs its general sensibility, and at the same time paralyses the particular sense, while an increasing warmth communicates to the over-sensible skin an increased nicety in the fulfilment of its office. If, then, an highly organized tissue can, through the withdrawal of some of the conditions of its healthy state, become utterly unserviceable as a means of distinguishing the surfaces of

bodies, what shall we say of integuments, which not only do not wince under the poisoned barbs of thistles and stinging nettles, but which in many instances carry within them and are full of liquids so caustic, that we employ them for the vesication of our own skins? and though the induction is but partial, the objection will apply universally; for who would dream of granting to one insect what he denied to another?

“It is the more important to attend to this, because many esteemed writers on Entomology,—though forced by the conduct of an insect when injured, to admit that he shows small evidence of general sensibility,—have yet, when their subject brings them to speak of touch in the abstract, made it the great instrument by which the wonders of insect architecture are accomplished. Thus, although unable from what they see to impute much general sensibility to the spider, they yet assert that the delicacy of his touch is displayed beyond the possibility of doubt; and that the fact of his working his nets with his hind legs, and in the dark, indicates that this sense, being the only one which he can turn to account, possesses an additional portion of accuracy in compensation for the help which it would otherwise have derived from the sense of sight. Now this is certainly an inconsistency; but the after assumption which is resorted to for a particular end does not invalidate the previous admission. Whoever contents himself with simply recording what he sees, and does not go out of his way to suppose a power of which there is no evidence, (!!) in order to explain, and that very inadequately, the marvellous works of bees and spiders, will admit, that as insects give very equivocal signs of any diffused sensibility, their possession of the sense of touch must be proportionably obscure; while the exquisite degree of it which has been pretended, must be seen to be utterly unfounded. And yet this is the favourite sense with Entomologists, and the one to which they refer almost all the operations of insects;—by touch alone, by the mere crossing of the antennæ, ants are said to deliver themselves of matters arising in the conduct of their affairs, to record which whole sentences are required; while the *tactus eruditissimus* of bees discerns the presence and applauds the mandates of their queen. To what purpose is all this waste of suppositions? The geometrical figure of the web or the cell, the activity of the makers of them, sustained until the completion of their task,—all in the wonder that is most wonderful, remains as unexplained as ever!”

But if the sense of touch has no share in producing the mar-

vellous works of bees and spiders alluded to, by what means are they accomplished? Our author is silent.

SIGHT.

“He that would assert the title of insects generally to the possession of this sense, is already in possession of two important arguments to start with. An organ can be pointed out in which to lodge the supposed faculty; and as that faculty is, from analogy, the most useful of all the senses, it would seem an anomaly that an intelligent creature (the intelligence, however, being entirely assumed, and for the present unchallenged,) should have been created without it. The greater number of insects, then, must be admitted to have what most physiologists would call eyes; but whether they are properly so called, can only be fully determined by the function they exercise, in inquiring into the exercise of which it may perhaps be not very difficult to show, that they differ entirely from organs of sight as we possess them and understand them.” The structure of the eyes of insects is then noticed: and Marcel de Serres and Cuvier are quoted to show that their “composition exhibits externally a cornea of various degrees of convexity, cut into facettes or corneules, whereof each is supposed to represent an eye. All these corneules are lined on their inner surface with an *opaque varnish, and this varnish affords no passage for the transmission of light.* Secondly, a number of short hexagonal prisms, entering the concavity of the lenses, come into contact with this varnish, and these it is usual to consider as so many retinae, each having that relation to the particular lens with which it communicates. Next in order comes the choroid, which is penetrated by the prisms just mentioned, and which are given off from beneath it by the general expansion of the optic nerve, properly called the retina.” “The insect being absolutely and unavoidably subject to the same external conditions for vision as ourselves, cannot be supposed to see through a *black pigment*, any more than we can through a *white cataract*; and as all insects equally have this black pigment, *all must be equally blind.*”

I was not prepared for this, nor, I should think, are any of my hearers. The presence of an optic nerve is not denied; and of what use is an *optic* nerve if not for sight? Mr. Newport has proved,* as I thought, that a bee flies straight to its hive by the sense of sight alone; but it is said “if insects want a brain of

* Trans. Ent. Soc. of London, Vol. IV, p. 57.

what use are eyes?” How then do they fly straight to their homes? Or to take an instance familiar to every one—how does a dragon-fly hawk for his prey and dart unerringly upon it if he be blind? There is no answer, unless this is an answer, “ that it would be wiser to leave their conduct unexplained than to resort to an explanation which is no explanation at all, or which proves too much; for many of the actions of bees and spiders, if they imply sight, imply also an intelligent and spontaneous use of it.” Do their actions, then, imply less intelligence if their authors be blind?

SMELL.

“ The general objection still obtains here—the absence of a brain to receive the message of the sense and to determine the consequent act.” The attraction of insects to certain plants and substances is then noticed; and it is added, “ but if we hesitate to admit or deny the sense of smell to insects, in what other way can we explain, or how indeed can we explain at all, such facts. Indeed we know not! but this we certainly know, that there are many acts performed by insects which cannot be explained at all by the operation of any of the senses, nor by all of them together; acts which we are fain to refer, accordingly, to the mysterious power called instinct.” So that because we cannot account for some of the acts performed by insects, we are to give up each one of them as inexplicable. It would be about as wise to give up the Newtonian theory of the universe, because we cannot thereby fully account for the falling stars. Can any one doubt that the flesh-fly visits carrion and that moths are attracted to sugar by the sense of smell?

TASTE.

“ ‘ Without taste,’ says an eminent modern writer, ‘ no animal could continue its existence; it is a sense indispensable to all organized beings, though its peculiarities cannot always be traced to the structure or form of the organs.’ This statement, however, is an assuming of the question, nor is it possible to acquiesce in it. Do not the absorbents select without tasting, and are not some animals little better than absorbents? That some insects show a marked preference for this or the other kind of nourishment is, if true, anything but conclusive as to their taste; for one is at a loss to conceive how, if insects were led by flavour to the choice of food, so many should be found to feed on insipid substances.” Now I do not see that this disproves the power of

tasting, for these substances, though insipid to us, may be palatable and relishing to insects. Few that have seen the *penchant* of certain insects for substances to us disgusting or insipid, and the avidity with which they devour them, can doubt this. Do we not say they have a "taste" for such things, and by what other words can we express the idea?

HEARING.

Many have been the theories as to the seat of this sense in insects, and it is a matter not yet satisfactorily determined; nevertheless there are so many facts in insect economy that imply the possession of it, that it has not hitherto been possible to deny its existence in some insects at any rate. Why have they the power of making a noise if not to be heard by others of their species? And that such is the case is proved by the answers returned to them. Yet this sense, like the others, our author denies they possess, and curiously recites the following in corroboration. "The melancholy clik of the death-watch (*Anobium*) loses all its terrors when it is found that the ominous sound is not a voice, but the result of mechanical friction. You have only to send him a counter-seratch from your side of the wainscot, when, mistaking you for a brother *Anobium*, he returns the signal." Why, is not this admitting that he *heard* the noise?

Under this head (though I do not see any connexion therewith) follows a number of instances of the wonderful proceedings of insects, "none of which," says Dr. Badham, "can proceed from sensuous impressions, if what has now been written against the probability of insects possessing the senses be correct." It is added, "from the above examples, which it would be foreign to my purpose and useless to multiply, it appears that the intelligence which prompts the actions of the dog, or of the higher animals generally, has no share in bringing about any of those of which insects are the agents. First, because, as we have seen, anterior to all experience or apprenticeship, they execute faultlessly whatever they have to do. Secondly, because on the supposition of the conduct of an insect proceeding from intelligence at all, we should be obliged to admit that he shows in one part of his conduct a greater and in another a less amount of it than could possibly proceed from one and the same individual; and lastly, because many of the daily actions of insects cannot be explained by referring them merely to intelligence, but suppose prescience as well, which, as it is not an attribute of brutes, can much less be supposed to belong to creatures so vastly below them as insects."

To what conclusion then are we to come? It is, that all the phenomena of insect life are referable to instinct, which is held to be synonymous with vitality,—“instinctive and vital acts being but different manifestations of life, executed in accordance with the pre-established harmony between the creature and the external world.”

I do not now propose to examine the physiological doctrines propounded in this book; I only contend that the facts of insect life do not bear out the theory. For in insects we see organs analogous to the organs of the senses of the higher animals, and perceive actions performed, which, if proceeding from the higher animals, we should at once acknowledge as conclusive proof of sensation; and I do not think that we are warranted in assuming that such creatures as insects are destitute of sensation, because we cannot trace a complete identity with the higher animals in the structure and functions of their organs or their nervous system; nor in disputing the possession of a faculty (such as hearing) when we see its manifestation, because we do not know the organ by which it accomplished its purpose.

XLVIII. *On two new Sub-Genera of Australasian Chrysomelidæ, allied to Cryptocephalus.* By W. W. SAUNDERS, Esq. F.L.S.—(continued from p. 270.)

[Read 5th April, 1847.]

CHLOROPLISMA, W. W. S. Χλωρος, σπλισμα.

Head vertical, immersed in the thorax up to the eyes, with the parts of the mouth but little projecting. *Eyes* reniform, with a deep sinus, in front of which the antennæ are inserted. *Antennæ* (Pl. XV. fig. 6a) nearly filiform, about as long as the body, 11-jointed; first joint robust, pyriform, second orbicular, third, fourth and fifth slender, the fourth the shortest and about half the length of the fifth, the remaining joints somewhat more robust and shorter than the fifth joint, gradually decreasing in length towards the apex, terminal joint ovate pointed. *Thorax* trapeziform, convex on the upper surface, with the posterior angles slightly